immersed, so there will be no sparks and the resistance will be constant. It is important that the two wires from the mercury troughs *o*, to the electro-magnets *k*, *k'* and on to the junction should have the same resistance, for if not it would be impossible to get a uniform current from the battery 2. Nearly if not quite all the objections to the mercury contact at the lower end of the pendulum are here done away with. The battery 1 may be of very low electro-motive force; the circuit is short, so that there will be hardly any self-induction to produce sparks. The mercury globule being in a vacuum, and if thought well in a hydrogen vacuum, its surface cannot get oxidised. As to the shape of the globule, a circular one, that is, one with a circular horizontal section, would not be good, as, if by chance the pendulum should swing not always in the same plane, but sometimes nearer the front and sometimes nearer the back, the duration of contact would not be uniform, therefore the duration of impulse would vary, which would be fatal. A long globule, then, with parallel sides would be free from this objection.

There is one more point of importance, which is the regulation of the clock. The pendulum would be made as nearly right as possible by the ordinary methods, after which the final regulation could be obtained with the greatest nicety without touching or interfering with the pendulum in any way. As a pendulum swings more slowly in a large arc than in a small, it follows that, by putting the electro-magnets *k*, *k'* nearer to the pendulum, and so increasing their action on it, it would swing through a larger arc and therefore more slowly; and in the same way, by putting them further off, the pendulum would go faster. The two magnets *k*, *k'* would be capable of being moved towards or from the pendulum according as the clock gained or lost. Lastly, the movement of the arm F could be made to send any number of currents every second without in any way interfering with the clock.

Ninth Catalogue of New Double Stars discovered with the 6-inch Refractor. By S. W. Burnham.

The following list comprises the new pairs found with the 6-inch Clark Refractor in the latter part of 1876 and the first part of 1877. During this period most of the time was devoted to the examination of known double stars, and but little attention given to the discovery of new objects. Many of these have been since observed by Baron Dembowski and Professor A. Hall, and their measures are given here.

Since July of the present year this series of double star observations has been continued with the 18·5-inch Clark Refractor of the Dearborn Observatory, and it is hoped that in some respects at least the results obtained have a proportionately increased value.

No.	Designation.	R.A. 1880. h m s	Decl. 1880. ° ′	Pos. °	Dist. ″	Mags.
453	Arg. (56°) 338	1 37 8	+56 31	218·7	1· ±	9·0... 9·5
454	O² Arg. 8280	8 10 12	−30 29	18·6	2· ±	8·0...10·0
455	L 18231	9 8 33	+ 4 43	65·2	1·94	9·5...10·5
456	L 22020	11 30 44	−11 41	68·2	0·65	9·0... 9·0
457	O¹ Arg. 11836	11 55 15	−20 51	84·3	0·89	8·0... 9·0
458	L 22677	11 58 8	−20 22	240· ±	20· ±	8·0...10·0
459	W¹ XII. 689	12 41 58	+ 4 7	285·2	3·61	8·5...11·0
460	W¹ XIII. 273	13 18 40	−15 0	215·2	2·07	8·0...10·5
461	W¹ XIII. 850	13 50 36	+ 3 34	220· ±	20· ±	7·5...11·0
462	Lam 1702	14 23 46	− 3 11	324·4	2·01	9·5... 9·8
463	...	18 10 46	−16 55	...	1·3 ±	9·0... 9·3
464	W¹ XVIII. 476	18 21 45	+ 6 29	111·3	1·20	8·5... 9·5
465	Arg. (56°) 2130	18 41 38	+56 45	293·2	3·06	9·0...11·0
466	W¹ XVIII. 1503	18 59 34	+10 39	167·7	1·64	9·0...10·0
467	O¹ Arg. 19936	19 39 24	−21 49	140· ±	1·8 ±	8·0...10·5
468	L 37571	19 39 58	+ 3 57	182·4	9·55	7·0...11·3
469	W² XIX. 1757	19 54 28	+24 24	175·4	14·42	8·3...10·6
470	O² Arg. 20079	20 3 41	+63 25	213·8	2·32	9·5...11·0
471	Arg. (61°) 2046	20 41 1	+62 0	125·9	1·46	10·0...10·0
472	Arg. (61°) 2078	20 57 12	+61 23	6·5	0·66	8·3... 8·5
473	...	21 1 26	−10 42	115·4	1·70	9·0...10·0
474	O² Arg. 23373	22 1 2	+60 25	360· ±	10· ±	8·5...11·8
475	L 43305	22 6 15	− 8 36	240· ±	1·5 ±	7·5...11·0
476	W² XXII. 180	22 8 41	+30 48	93·1	2·62	9·5...10·0
477	W² XXII. 225	22 10 28	+30 49	45·9	6·42	9·2...11·0
478	Lam. 4578 A and B	22 23 8	− 7 56	32·6	1·26	10·0...10·0
	A and C			239·0	28·45	10·0
479	Arg. (67°) 1444	22 26 28	+67 33	29·8	2·42	9·7...11·2
480	W¹ XXII. 716	22 35 18	+ 4 6	63·1	0·79	9·5...10·0
481	W¹ XXII. 1162	22 56 23	−11 53	53·0°	1·31	9·0... 9·5
482	Arg. (62°) 2350 A and B	23 55 44	+62 39	360· ±	4· ±	8·5...10·0
	A and C			150· ±	10· ±	11·0

Notes.

453. A very difficult pair, the distance of which was at first estimated 1″·2. Baron Dembowski could not see it double, and upon a re-examination with the 6-in. on two or three good nights I was unable to see any certain trace of duplicity. Subsequently I tried it with the 18½-in. of the Dearborn Observatory, and obtained a fair measure of the position-angle. I found the distance much overrated, and the esti-

mate given above is probably still too large. It was a difficult object even with the large aperture, and impossible to measure in distance on this occasion. When discovered the entry made no mention of its being a particularly difficult pair.

454. Position-angle measured with the 6-in.

455. Measures by Prof. A. Hall (*Astr. Nach.* 2147), with the 26-in. (1877·3), on two nights. In Lalande this star is $7\frac{1}{2}$ magnitude. When found it appeared to be about 8·5 mag.

456. Excessively difficult; the most northerly of two small stars in the same field. Measures by Prof. A. Hall (*Astr. Nach.* 2147), with the 26-in. (1877·3), on two nights.

457. Measures by Prof. A. Hall (*Astr. Nach.* 2147), on two nights, with the 26-in.

458. Noted in observing the preceding pair.

459. Measures by Baron Dembowski (1877·5); two observations.

460. Measures by Baron Dembowski (1877·4); two observations.

461. Very minute distant companion.

462. A pretty but faint pair, directly south of Σ 1852 *rej.* Measured on two nights by Baron Dembowski (1877·5).

463. Not in any star catalogue I have. Place with micrometer from H 2824.

464. A third star, 11 mag., 90° : 25″. Measures by Baron Dembowski; two nights (1877·6). In a low-power field with OΣ 350.

465. Measured once by Baron Dembowski (1876·8).

466. Measured once by Baron Dembowski (1876·7).

468. Found in looking for OΣ 381. Observed three times by Baron Dembowski (1876·9).

469. A mean of three observations by Baron Dembowski (1877·0).

470. In the field with Σ 2642. Measures by Baron Dembowski; one night (1876·8).

471. A pretty little pair; found in looking for H 3000. In Argelander 9·4 magnitude. Measured once by Baron Dembowski (1876·8).

472. The wide pair in the field, south, is H 1607. Measures by Baron Dembowski; two nights (1877·2).

473. Not found in any star catalogue I have. A mean of two measures by Baron Dembowski (1876·7).

475. Very unequal and difficult pair.

476. This and the next in the same low-power field. Both measured by Baron Dembowski on two nights (1876·8).

478. Measured once with the $18\frac{1}{2}$-in (1877·8). Very difficult with the 6-in. There is a fourth smaller star, about the same distance as C in the opposite quadrant.

479. This makes, with two 8–9 magnitude stars, all in the field, a small equilateral triangle. A difficult object. Measured once by Baron Dembowski (1876·8).

480. Very difficult. Measures by Baron Dembowski; one night (1876·9).

481. Very difficult pair in the field with Σ 2970. Measures, one night, with the $18\frac{1}{2}$-in. (1877·8).

482. For the close pair Baron Dembowski, by two observations, gives 342°·7 : 4″·07 : 10·0...11·0 (1877·2). The principal star in Argelander is 8–9 magnitude.

Chicago, Nov. 5, 1877.

Extract from a Letter from the Rev. F. Howlett, to W. T. Lynn, dated 1877, *November* 3.

By this post I forward you careful drawings of the fine solar spot (now on the disk) for October 31 and November 1, taken by projection, power 120, and screen 5 ft. 2 in. from eye-piece, when each half-inch subtends just 15″. The main spot must have been very near the solar equator, especially when we consider that the Sun's north pole is now within the margin of the disk.

The lesser group "followed" the principal one after an interval of about 4′ 30″.

I would add that a friend who was watching me as I took the drawings noticed, as well as did I, a very distinct *haze* of a kind of bistre-brown colour extending for some 10″ or 12″ upon the penumbra, beyond the margin of the umbra, on October 31, as well also as a considerable sized nucleus of about 12″ diameter within the umbra.

The definition on October 31 was very fine, and it was very good also on November 1, though I could barely distinguish any of the bistre-brown haze or the nucleus on the latter day.

The "bridge," extending more than half-way across the umbra, was not very luminous on October 31, and still less so on November 1, and on each day aforesaid terminated in very faint flocculent matter.

To-day (November 3), this flocculent matter is very much feebler still, and is all that remains of the "bridge."

Note on a Special Case of "the Most Probable Result" of a Number of Observations. By J. M. Wilson, Esq., Rugby.

It is beyond the reach of all but pretty good mathematicians to follow the reasoning about "probable errors" and "the most probable results" of a number of discrepant observations. But there is one law of weighting observations which lends itself so easily to calculation that perhaps some of the non-mathematical readers of the *Notices* may be interested in seeing it. The result is not new, though it was quite new to me when I first observed it, some six or seven years ago, and I do not remember to have seen it since, except in Mr. J. W. L. Glaisher's paper in the *Memoirs* for 1872.

A number of numerical readings are made of some magnitude that is to be measured; they differ from one another. What is the most probable result? The common method is to take their arithmetical mean; and if the readings are tolerably evenly distributed this will not give a bad result. But if one reading is widely different from the others, the doubt occurs whether it ought to be wholly rejected or have less weight assigned to it.